	L #	Hits	Search Text	DBs
1	L1	273	animal same cage same (transparent or translucent)	USPAT; US-PG PUB; EPO; JPO; DERW ENT
2	L4	45	1 and (red or colored or tinted or coloured)	USPAT; US-PG PUB; EPO; JPO; DERW ENT
3	L5	34	1 and (red) US 6,357,394 found here	USPAT; US-PG PUB; EPO; JPO; DERW ENT
4	L6	11	4 not 5	USPAT

Optical Properties of Plastics

Light Transmission

Plastics differ in their ability to transmit light. Some plastics are ***transparent***, exhibiting optical properties similar to glass. Other plastics are ***opaque***, and do not allow any light to pass through. ***Translucent*** plastics allow some light to pass through them, but the images are cloudy and unfocused. Lastly, some plastics are ***semi-opaque***, allowing enough light to pass through them to be able to make out shadows and vague outlines. Since the boundaries between these different light transmission values are unclear, there are some rules of thumb. If a newspaper is placed on the other side of the plastic, and it can be easily read, the plastic is transparent. If it is cloudy and cannot be read, but general shapes can be distinguished, then the plastic is translucent. If only vague shadows can be discerned, the plastic is semi-opaque. If no light is transmitted, the plastic is opaque.

Some plastics used for their transparency properties are acrylic, polycarbonate, and polystyrene. Some examples of parts are plastic lenses for eyeglasses, bullet proof glass, and automobile headlight assemblies. Unlike glass, extended exposure to UV light degrades the polymers, causing plastics to yellow and become cloudy.

The polymer crystallinity of the plastic plays a major role in determining the optical properties of plastic. In a highly crystalline polymer like high density polyethylene and polypropylene, the polymers fold up and form orderly crystals at the plastic solidifies after being melted. These polymer crystals are approximately the same size as the wavelength of visible light, causing the light to scatter. As a crystalline material is melted, if does not have any fillers that will scatter light, it will change from opaque to transparent because the crystalline structure disappears. Amorphous polymers, like acrylic, polycarbonate, and polystyrene do not form crystals; they are naturally transparent. In general, transparent polymers are noncrystalline and translucent polymers are crystalline. This not the case in crystalline PET (soda bottles), which is transparent because the crystal size is not visible light's wavelength. Fillers and additives will usually decrease the light transmission of a plastic.

Index of Refraction

The index of refraction is a measure is how much light bends when it hits an object. If the object has in index of refraction near that of air, the object will be transparent. Glass, polycarbonate, polystyrene, and acrylic all have indices of refraction close to air. When making transparent parts, designers must be careful to keep materials with the same index of refraction together, or else the light will bend in different direction and distort the image.

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